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ABSTRACT

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The Growth of Higher Education in the United States*

April 1971

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INTRODUCTION

The higher educational system in this country has expanded at an astounding rate during the last decade. Part of this expansion is attributable to the growth of the college age group as an aftermath of the post-World War II baby boom; the population in the 18-21 age group has risen by about 50% from 1960 to 1970. During the same period the high schools have cut their drop out rates sharply; it is estimated that 78% of the young people are graduating from high school today as compared with 67% ten years ago. Also, an increasing proportion of the high school graduates are going on to college--approximately 60% at the present time as compared with 50% only ten years ago.

As a result enrollments in colleges and universities have soared. (See Table 1 and Figure 1.) Despite the negative effects of the Vietnam war upon college enrollment rates, undergraduate enrollment has more than doubled during the last decade. Graduate enrollment has risen even more rapidly, doubling in the last 7 years, tripling in only 12 years. Total opening fall enrollment in institutions of higher education rose from 3.8 million in 1960 to 8.5 million in 1970, an increase of over 120% in ten years.

With the high schools continually reducing their drop-out rates and a higher percentage of high school graduates going on to college, our colleges and universities are serving an ever-broadening segment of the population. The notion that the colleges are to be reserved for only the more academically talented students (and those from well-to-do families) appears to be eroding with time in almost the same way that the corresponding notion about the high schools did 30 or 40 years ago.

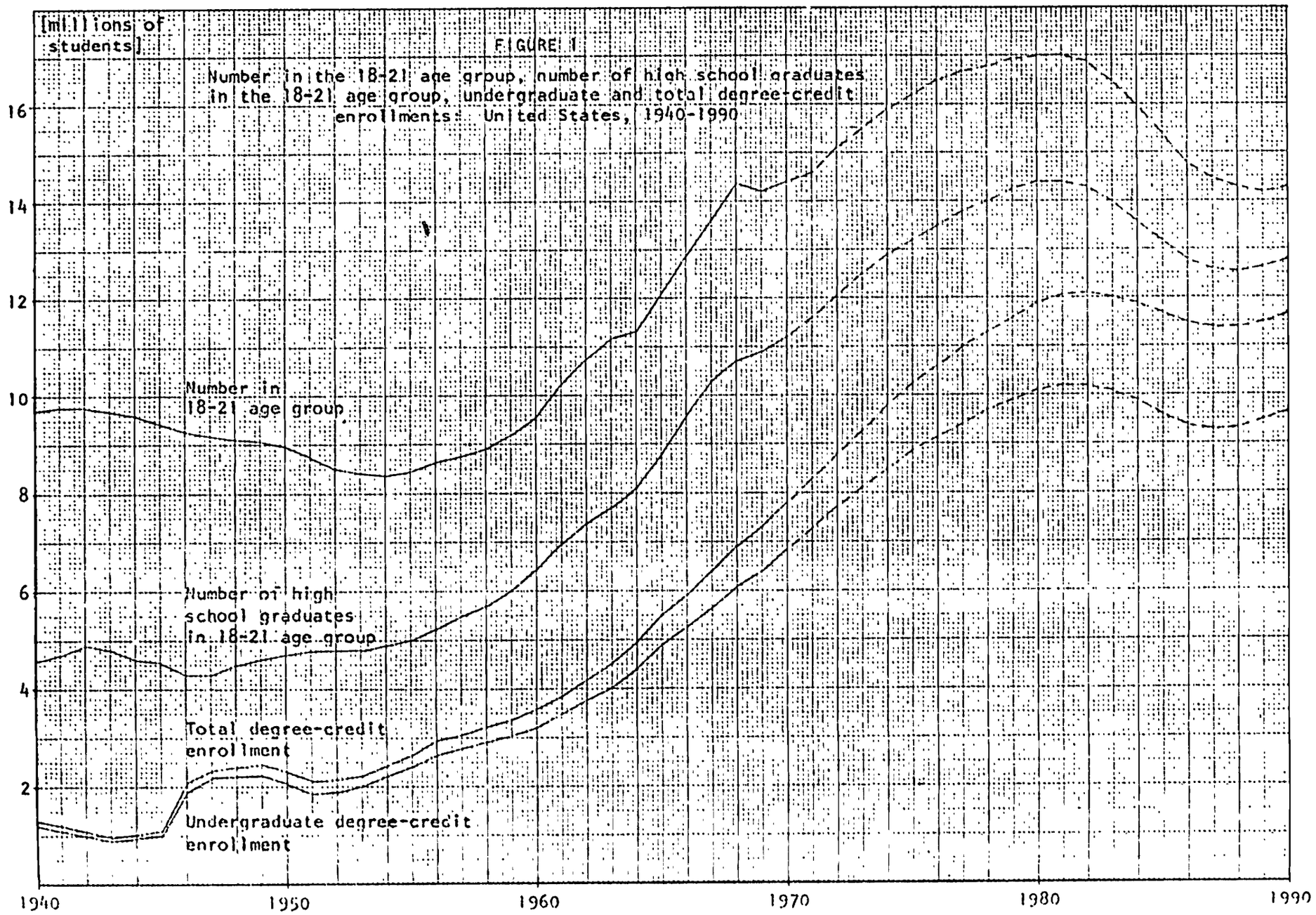
Table 1

Summary of Enrollments in Institutions of Higher Education by Degree-credit Status, Level, and Sex: United States, Fall, 1929-1970 with Projections to 2000 (All data are in thousands)

Year	Total enrollment			Degree-credit enrollment								
				Total			Undergraduate*			Graduate resident		
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total
1929	--	--	--	451	350	801	429	337	766	22	13	35
1939	--	--	--	816	549	1365	755	513	1268	61	35	96
1949	--	--	--	1722	723	2445	1562	665	2227	160	58	218
1959	2298	1274	3571	2161	1216	3377	1920	1121	3041	241	95	336
1960	2401	1388	3789	2257	1326	3583	2001	1223	3224	256	103	358
1961	2537	1510	4047	2409	1452	3861	2131	1341	3472	277	111	388
1962	2743	1661	4404	2587	1588	4175	2283	1461	3743	305	127	432
1963	2955	1811	4766	2773	1722	4495	2439	1578	4017	334	144	478
1964	3249	2031	5280	3033	1917	4950	2659	1751	4410	374	166	540
1965	3630	2291	5921	3375	2152	5526	2958	1961	4919	416	191	607
1966	3856	2534	6390	3577	2351	5928	3126	2137	5263	451	214	665
1967	4133	2779	6912	3822	2570	6392	3326	2323	5649	496	247	743
1968	4478	3035	7513	4119	2809	6928	3595	2525	6120	524	284	808
1969	4695	3222	7917	4310	2970	7280	3760	2650	6410	550	320	870
1970	4991	3507	8498	4560	3220	7780	3960	2870	6830	600	350	950
Projections												
1971	5350	3750	9100	4870	3420	8290	4220	3040	7260	650	380	1030
1972	5740	4000	9740	5200	3650	8850	4500	3230	7730	700	420	1120
1973	6080	4240	10320	5500	3850	9350	4740	3400	8140	760	450	1210
1974	6390	4480	10870	5760	4060	9820	4950	3570	8520	810	490	1300
1975	6660	4710	11370	5990	4260	10250	5130	3730	8860	860	530	1390
1976	6900	4920	11820	6190	4430	10620	5270	3870	9140	920	560	1490
1977	7110	5110	12220	6370	4610	10980	5400	4010	9410	970	600	1570
1978	7310	5290	12610	6550	4770	11320	5530	4140	9670	1020	630	1650
1979	7500	5460	12960	6720	4910	11630	5660	4250	9910	1060	660	1720
1980	7640	5600	13240	6840	5030	11870	5740	4340	10080	1100	690	1790
1985	7390	5560	12590	6660	5020	11680	5410	4210	9620	1250	810	2060
1990	7320	5640	12960	6590	5080	11670	5360	4290	9650	1230	790	2020
1995	8240	6510	14750	7350	5830	13180	6110	5010	11120	1240	820	2060
2000	9360	7560	16920	8310	6730	15040	6910	5780	12690	1400	950	2350

SOURCES: See Appendix.

*Includes first-professional and graduate extension students.



Nevertheless, as will be shown in this report, the overall attrition rates for undergraduates have remained virtually unchanged for the last 20 years. Also, the proportion of entering students who eventually graduate from college has remained stable at about 50% throughout this period. Thus, on the whole the higher educational system appears to be continually adjusting to accommodate a more representative segment of the population with no apparent increase in the overall attrition rates.

This would seem to imply that the institutions are lowering their admission standards and that there is a gradual "watering-down" of courses within the institutions. However, before jumping to this conclusion, we should consider the directions in which this expansion is taking place. First of all, a smaller proportion of the students are electing to enter those fields usually considered to be more academically demanding, particularly the ones that are more mathematically oriented. As is evident from the numbers of bachelor's degrees awarded in the various fields, there has been a long-term trend away from the natural sciences and mathematics toward the humanities and the social sciences. Whereas the total number of bachelor's degrees awarded doubled in the last decade, the number of degrees with majors in the natural sciences and mathematics rose by about 50%, which just matches the growth rate of the college age group during the same period. This suggests that, at least in part, it is the students, not the institutions, who are making the adjustment.

Secondly, the distribution of students among the different types of institutions is changing rapidly, with the more selective institutions taking a smaller and smaller proportion of the entering students. In particular, the private institutions, with their generally higher admission standards and rapidly increasing tuition rates, have not kept pace with

the state-supported institutions in providing places for new students. In 1950, enrollments were almost equally divided between the private institutions and the public institutions; today, three out of four students attend public institutions.

To accommodate this shift in the enrollment pattern from the private institutions to the public institutions in addition to the other growth factors, the states have expanded their higher educational facilities at an incredible rate. As a result, there are five times as many students in public institutions in 1970 as there were in 1950. To meet the enrollment crush, many states have created large numbers of low-tuition junior colleges and four-year colleges with more lenient admissions policies than the private institutions and the public universities. In addition to removing the financial and academic barriers to college attendance for many students, this expanding network of public colleges, in conjunction with the shift of the population to the cities, has also served to reduce the geographic barrier for potential students. Today most high school graduates have an "open-access" institution, one that admits most high school graduates and charges low tuition, in the same locality as their high schools. For most of these students, the transition from high school to college presents little more of an obstacle than the transition from junior high school to high school. This increasing accessibility of institutions to more of our youth has provided a further impetus to the demand for higher education. With the continuation of the junior college movement, it is conceivable that by 1980 close to 95% of the population will live within commuting distance of an open-access institution.

This analysis will concentrate upon trends in high school graduation rates, college entrance rates, attrition rates, and so forth so as to provide better knowlege of the flow of students through the higher educational system and the effects of such factors as the draft, the G. I. Bills, and economic factors upon enrollments at the various levels. The statistical models used, which embody assumptions about the gradual leveling off of enrollment rates at all levels, are chosen with a view toward providing a basis for making long-term projections of enrollments and degree production based upon past trends in enrollment patterns and the anticipated sizes of certain age groups.

The resulting projections of total enrollment and degree-credit enrollment by level and sex are given in Table 1. According to these projections, total enrollment will rise at a rate of about one-half million students per year for the next ten years. Then it will begin to level off and remain rather stable throughout the 1980s with a slight decline beginning in 1982 or 1983 as a result of a sharper decline in the size of the college age group. The projections of undergraduate and total degree-credit enrollment are indicated by the dotted lines in Figure 1. The methodology behind these projections and comparisons with other projections will be discussed below.

It should be noted that the term "undergraduate enrollment" as used in this report includes both first-professional students and graduate extension students in addition to the "true" undergraduate enrollment, which will be called the "prebaccalaureate enrollment" in this report. The reason these postbaccalaureate students are included in the undergraduate enrollment category is to take advantage of the relatively consistent and unbroken time series of enrollments in this category.

In 1968, the first year that prebaccalaureate enrollment was gathered in the opening fall enrollment survey, there were 6,476,000 prebaccalaureate students, of whom 5,891,000 were enrolled in degree-credit programs. Thus, the estimated undergraduate degree-credit enrollment of 6,120,000 in 1968 includes 229,000 postbaccalaureate students. Estimates of prebaccalaureate enrollment for the years 1960-70 with projections to the year 2000 are given below in Table 11.

With the above exception, the terms used in this paper to describe the various enrollment and degree classifications, such as "degree-credit," "first-professional," "bachelor's degree," and so forth are intended to be consistent with the definitions appearing in recent publications of the National Center for Educational Statistics, U. S. Office of Education. The NCES pamphlet Projections of Educational Statistics to 1978-79 (1969 edition) [22] is particularly helpful in this regard; it also contains convenient tabulations of data for the last ten years on enrollments in various categories, degrees, high school graduates, expenditures, and teachers. In some instances, estimates of enrollments in this report differ from those given in the Projections, particularly those for graduate resident enrollment for the last few years. The sources of the enrollment data used here are given in the appendix. Another convenient source of historical data is the NCES publication Digest of Educational Statistics, 1970 Edition [17].

THE INCREASED HOLDING POWER OF THE HIGH SCHOOLS

Much of the growth in enrollment in higher education over the last two decades is attributable to the growth in the number of high school graduates over this period, which in turn is closely related to the increased sizes of certain age groups. During the last decade the number of high school graduates has risen 58% whereas the size of the corresponding 18-year-old age group (i.e., the number of 18-year-olds as of July 1) has risen only 42%. The ratio of the number of high school graduates to the number in the 18-year-old age group has risen from 64% for boys and 71% for girls in 1959 to 76% for boys and 80% for girls in 1969. (See Table 2.)

Since close to one-half of the high school graduates are still in the 17-year-old age group at the time of graduation (see Table 9 of [36]), a more satisfactory measure of the "high school graduation rate" for year t is $Y(t) = H(t)/A(t)$ where $H(t)$ denotes the number of high school graduates during year t and $A(t)$ is the average of the sizes of the 17- and 18-year-old age groups. These ratios, which are given separately by sex in the last two columns of Table 2, exhibit a far more regular behavior than the corresponding ratios for 18-year-olds. In particular, note the behavior of these ratios for the years 1964 and 1965 when the sizes of the 17- and 18-year-old age groups spurted upward as a result of the post-war baby boom.

The plot of the graduation rates $Y(t)$ (Figure 2) indicates that the Vietnam War has affected the graduation rates only slightly and in a manner apparently mimicking that of the Korean War. We shall argue that, when comparing the effects of the Vietnam War with those of the Korean War,

Table 2

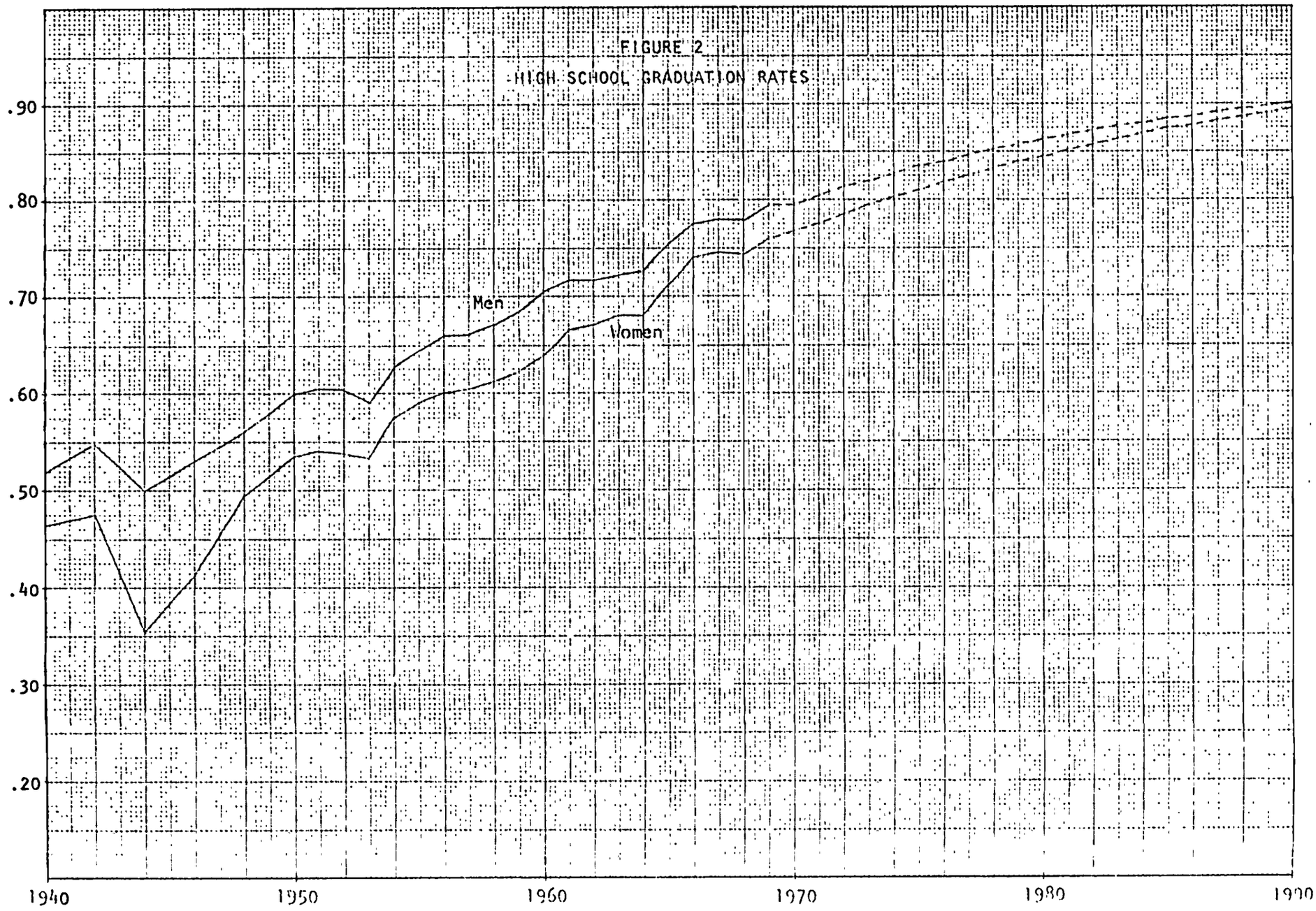
Number of High School Graduates as Compared with Population in Certain Age Groups*
(All data are in thousands)

	High School Graduates		Population Age 18		Ratios (2)/(4)	(3)/(5)	Ave. of Pop. Ages 17 and 18		Ratios (2)/(8)	(3)/(9)
Year	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1900	38	57	742	758	.051	.075	744	758	.051	.075
1910	64	93	910	913	.070	.102	907	912	.071	.102
1920	124	188	931	949	.133	.198	938	954	.132	.197
1930	300	367	1141	1155	.263	.318	1148	1158	.261	.294
1940	579	643	1243	1237	.466	.520	1248	1238	.464	.519
1950	573	632	1090	1074	.526	.588	1072	1056	.535	.598
1955	648	702	1074	1068	.603	.657	1100	1088	.589	.645
1956	682	739	1132	1113	.602	.664	1138	1118	.600	.661
1957	696	750	1148	1126	.606	.666	1152	1132	.604	.662
1958	729	784	1164	1143	.626	.686	1191	1170	.612	.670
1959	790	849	1228	1203	.643	.706	1268	1242	.623	.684
1960	898	966	1319	1287	.681	.751	1401	1368	.641	.706
1961	958	1013	1485	1454	.645	.697	1442	1410	.664	.718
1962	941	984	1402	1371	.671	.718	1405	1371	.670	.718
1963	959	991	1411	1376	.680	.720	1406	1370	.682	.723
1964	1123	1167	1402	1370	.801	.852	1648	1604	.681	.727
1965	1314	1351	1898	1843	.692	.733	1844	1788	.712	.756
1966	1326	1346	1794	1737	.739	.775	1792	1736	.740	.775
1967	1332	1348	1792	1739	.743	.775	1786	1730	.746	.779
1968	1341	1361	1781	1725	.753	.789	1806	1749	.743	.778
1969	1408	1431	1830	1776	.769	.806	1855	1798	.759	.796
					Projections					
1970	1470	1480	1880	1820	.782	.812	1910	1860	.768	.796
1971	1530	1540	1950	1900	.784	.814	1970	1920	.776	.806
1972	1580	1600	1990	1940	.797	.823	2020	1960	.786	.814
1973	1630	1630	2040	1980	.797	.824	2050	1990	.795	.821
1974	1670	1680	2060	2000	.814	.839	2080	2030	.803	.828
1975	1720	1720	2110	2060	.813	.836	2120	2060	.811	.834
1976	1740	1740	2120	2060	.820	.842	2130	2070	.819	.841
1977	1760	1750	2130	2080	.827	.846	2130	2070	.826	.847
1978	1810	1790	2130	2070	.849	.864	2170	2100	.833	.852
1979	1840	1810	2210	2130	.831	.848	2190	2110	.840	.858
1980	1820	1780	2170	2090	.839	.855	2150	2070	.846	.863
1985	1590	1550	1840	1780	.860	.870	1810	1750	.874	.885
1990	1680	1630	1860	1790	.904	.911	1880	1810	.894	.902
1995	1900	1840	2070	1990	.919	.923	2090	2010	.909	.914
2000	2120	2050	2290	2200	.928	.930	2300	2220	.920	.924

*Figures before 1950 exclude Alaska and Hawaii.

FIGURE 2

HIGH SCHOOL GRADUATION RATES



the years 1966-1968 should be compared with the years 1951-1953. Table 2 shows the similar behavior of the rates $Y(t)$ before and during these two periods.

Looking for increases in the size of draft calls seems a plausible way to determine when the Korean and Vietnam wars began to affect the number of high school graduates and enrollments in higher education. According to data given in [12], the draft calls for the Korean War began in September 1950, with a call for 50,000 inductions. To determine an analogous point for the Vietnam War, we note that the first draft call of over 20,000 came in September 1965, with a call for 27,400 inductions. During the next three months the number of inductions averaged over 37,000, while in the preceding three months (June, July, and August) the calls had averaged around 17,000 per month, and during the nine months before that the number of calls had averaged about 8,000 per month. Thus the month of September 1965 seems a reasonable choice to mark as the beginning of the Vietnam War in making comparisons with the Korean War.

In projecting high school graduates, we first assume that the ratios $Y(t)$ will continue to rise in a manner suitably approximated by a logistic growth curve, i.e., one of the form

$$f(t) = \frac{\gamma}{1 + e^{-(\alpha+\beta t)}}$$

for some parameters α, β, and γ where $\beta > 0$ and $\gamma > 0$. This curve is a monotonically increasing function of t which tends to the limiting value γ as t becomes infinite. It seems reasonable to assume that this limiting value is close to 1.0, say between .90 and 1.0, because of the already wide acceptance of the notion that eventually almost everyone will graduate from high school. Apparently our society

has come to regard the completion of high school as a minimal level of educational achievement in much the same way that completion of eight grades was regarded 20 or 30 years ago. At the present time, the percentage of boys and girls who complete eight grades is over 97% (see Table 1 of [31]).

To project future graduation rates, we have set $\gamma = .95$ for both boys and girls. The choice of the value of this parameter is not critical in that the choice of any other value between .90 and 1.0 leads to approximately the same projections for the next 10 years. Also, we first transform the ratios $Y(t)$ to $Z(t)$ where

$$Z(t) = \log_e [Y(t)/(.95 - Y(t))].$$

The parameters α and β are then estimated by fitting a line $z = \alpha+\beta t$ by least squares to the points $(t, Z(t))$ for the years from 1955 to 1968. If we set $t = 0$ for 1960, the resulting estimates of α and β are $\hat{\alpha} = .761$, $\hat{\beta} = .067$ for boys. $\hat{\alpha} = 1.033$, $\hat{\beta} = .063$ for girls. These estimates of α and β are then substituted into the growth curve $f(t)$ to project the ratios $Y(t)$ for the years 1969-2000.

The projections of high school graduates in Table 2 are obtained by multiplying the projected graduation rates $Y(t)$ by the projected values of $A(t)$ as derived from age-group projections by the Bureau of the Census given in [34]. These age-group projections should be extremely accurate through 1985 since the 17-year-olds of 1985 are alive today. For later years, the Series D projections of the Bureau of the Census have been used since this series predicted the birth rates between 1966 and 1969 with great precision. However, if the fertility rates should drop sharply,

the Series D projections of the 17- and 18-year-old age groups for the years 1990-2000 may be too high. On the other hand, even if future birth rates should drop far below the Series D rates, this may be more than offset by a rise in immigration rates in response to pressures resulting from the world population situation.

It is interesting to compare the projections of high school graduates in Table 2 with those given by the Office of Education in [22]. Their projections, which only extend to 1979, run slightly higher than the projections given here, but the differences are not great. Their projection of 3,773,000 high school graduates in 1979 exceeds ours by about 3%.

The Office of Education projections result from fitting a line by least squares to the points $(t, W(t))$ where $W(t)$ is the ratio of the number of high school graduates in year t to the estimated number of 18-year-olds as of October 1. In fitting this line, they have apparently used the data for the years 1958-68; the 1969 data on high school graduates was not available at the time. This close agreement between the two sets of projections indicates that the fitted logistic growth curve is approximately linear throughout the time interval under consideration. However, these differences become more and more serious with time, making linear extrapolation unsuitable for long-term projections.

THE TRANSITION FROM HIGH SCHOOL TO COLLEGE

It is clear from Figure 1 that much of the growth in undergraduate enrollment in the last 20 years is attributable to the increased numbers of high school graduates. In fact, some authors have gone so far as to claim that this accounts for all the growth in higher education. In a widely-quoted paper written in 1964, Jaffe and Adams [14] wrote:

> Roughly half of all the white men who graduate from high school go on to college. Roughly 4 in 10 white women and nonwhite students who graduate from high school go on to college....One assumption is that a larger proportion of high school graduates now goes on to college. We find, on the contrary, that the proportion continues to be the same.... We find that slightly over half the men are receiving their degrees and about 4 in 10 women are completing four years. These proportions continue long-standing trends. Clearly, the bulge in college applicants has resulted solely from the larger number of youngsters in these age groups and the larger proportion who graduate from high school.

Jaffe and Adams based their conclusions on the results of the 1940 and 1960 decennial censuses of the population. Their conclusions apparently depend on how many years of schooling people say they have completed in reporting their educational attainment to the census-takers, rather than the actual numbers of years completed. As an indication of the amount of bias that this can introduce, the Bureau of Census reported in [33] that in the 1960 census there was a net overreporting of educational attainment by about 6% of the population 25 years and older. Also, it is to be expected that overreporting rises with the age of the cohort: perhaps the term "boarding school" slips in usage to "college" over a period of years in the vocabulary of a person who attended such a school many years ago. Such misreporting and differences in mortality rates among groups having different levels of educational attainment could lead to gross overestimates

of college enrollment rates in the early part of this century. In this connection, it is interesting to note that the two sets of estimates of college entrance rates for the years 1900 to 1930 based upon the two censuses of 1940 and 1960 do not agree; the later census yields consistently higher estimates of entrance rates for the earlier years.

In the statements quoted above, Jaffe and Adams are apparently giving a rough overview for the entire period 1880-1960, whereas a close examination of their graphs indicates a slight upward trend in college entrance rates for both men and women since 1940. More recently, Jaffe and Adams [13] have reported that there has been an upward shift in the college entrance rates in the 1960s, which they attribute in part to the junior college movement and the lessening significance of the financial barrier to college entrance.

There has been a tremendous amount of research on plans for college attendance among high school seniors by sex, socioeconomic status, ability, academic standing, geographic location, and so forth. In some cases, follow-up studies have been made. The books by Medsker and Trent [16], Folger, Bayer, and Astin [8], and Jaffe and Adams [13] all give comprehensive treatments of the subject. In recent years, annual reviews of the new literature have been provided by Cramer and Stevic [6]. In this section we shall restrict our attention to the time trends in the college entrance rates, with primary attention given to the wartime effects upon first-time enrollments.

A "first-time student" is one who is enrolling in an institution of higher education for the first time, i.e., one who has not previously attended any other institution of higher education. For the purposes of this study, the "college entrance rate" will be defined as the ratio of

the number of first-time degree-credit students in the opening fall enrollment to the number of high school graduates during the same year.

The first-time degree-credit enrollments and the college entrance rates for the years 1947-70 are given in Table 3. Figure 3a gives a plot of the college entrance rates for the years 1940-70.

The college entrance rate for any year t will be denoted by $p(t)$. Thus, $p(t) = F(t)/H(t)$ where $F(t)$ is the first-time degree-credit enrollment in year t. Clearly, this is not a true measure of the proportion of high school graduates in year t who enter college. On the one hand, the numerator $F(t)$ excludes the high school graduates in year t who enter college a year or more after graduation, but this is counterbalanced by the inclusion of first-time students in year t who graduated from high school before year t. Also, students who enter college through nondegree-credit programs are excluded, but foreign students are included.

As an indication of how this measure of the college entrance rate compares with results of follow-up surveys of high school graduates, in a survey of the class of 1959 reported by Medsker and Trent [16], 57% of the men and 42% of the women attended college by 1963; the college entrance rates reported here for 1959 are: 62% for men, 39% for women. A Bureau of the Census survey [33] of the high school graduation class of 1966 showed that 52% of the men and 42% of the women attended college by February of 1967; the college entrance rates for 1966 were 59% for men and 44% for women. A more recent Bureau of the Census survey of the class of 1969, as reported in [11], showed that 60% of the male high school graduates and 47% of the female graduates were enrolled in college by October of 1969; the college entrance rates given here for 1969 are 68% and 52%. The percentages derived from the Bureau of Census surveys do not include the high school graduates

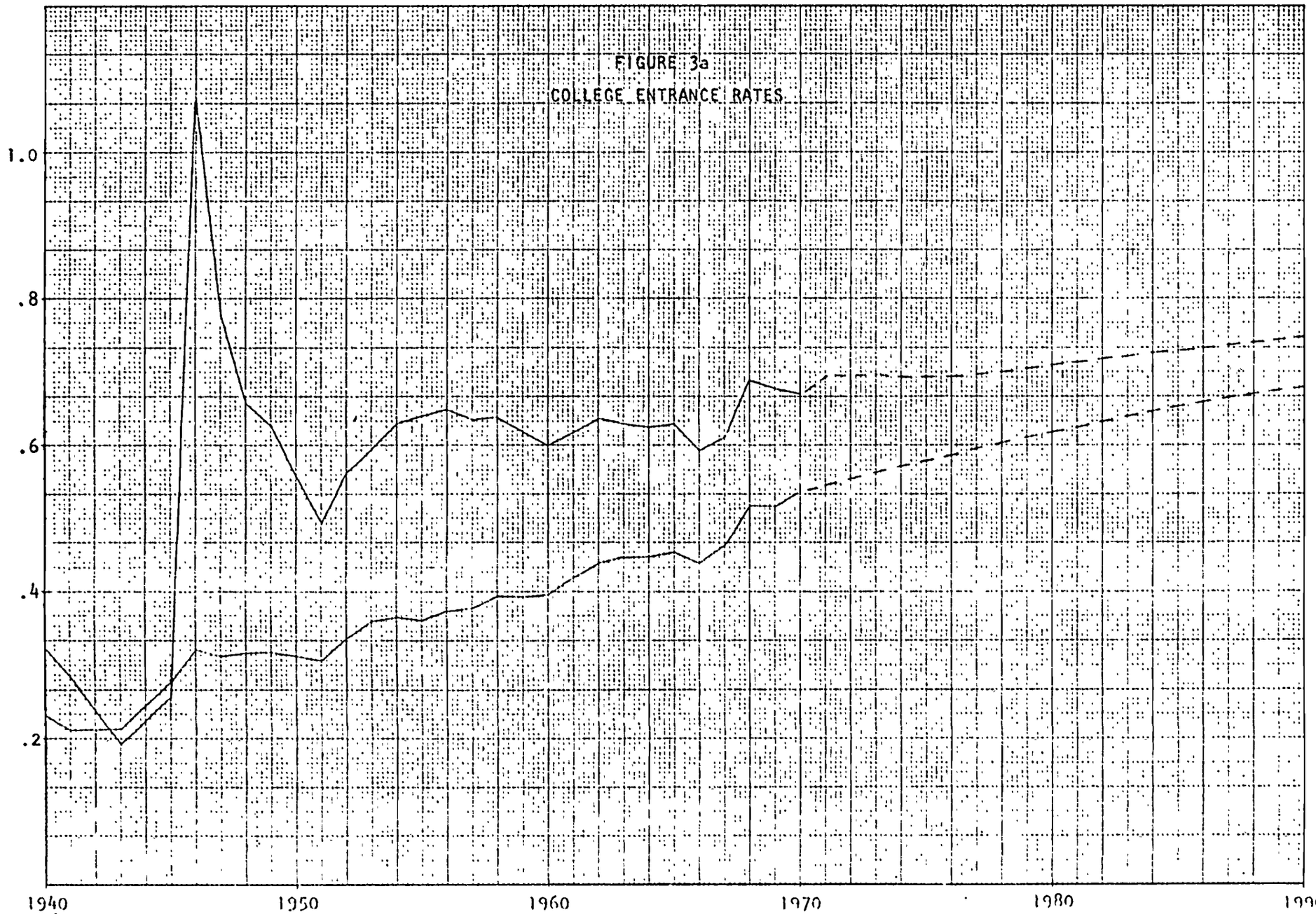
Table 3

First-time Degree-credit Enrollment, College Entrance Rates, Numbers of Veterans Entering Training, and Numbers of Wartime Inductions, 1947-1970
(All data are in thousands)

	First-time degree-credit enrollment		College entrance rate		Veterans entering training			Wartime inductions	
Year	Men	Women	Men	Women	WW II	Korea	Vietnam	Korea	Vietnam
1947	400	193	.777	.311	2330				
1948	369	198	.655	.316	1242				
1949	355	199	.629	.316	1006				
1950	318	196	.555	.311	732				
1951	279	191	.494	.307	545			552	
1952	322	212	.564	.337	35	46		438	
1953	343	225	.595	.359	14	302		472	
1954	384	243	.623	.365	9	470		253	
1955	416	254	.641	.362	5	487		153	
1956	443	275	.649	.372		435			
1957	442	282	.635	.376		311			
1958	465	310	.638	.395		217			
1959	488	334	.618	.393		103			
1960	540	384	.601	.397		42			
1961	592	426	.618	.421		23			
1962	598	432	.636	.440		14			
1963	604	442	.630	.446		4			
1964	702	523	.625	.448		5			
1965	829	613	.631	.453		1			
1966	787	591	.594	.439			311		382
1967	814	626	.611	.464			317		228
1968	925	705	.689	.518			421		296
1969	954	738	.678	.516			542		290
1970	985	795	.670	.537			590		164

FIGURE 3a

COLLEGE ENTRANCE RATES

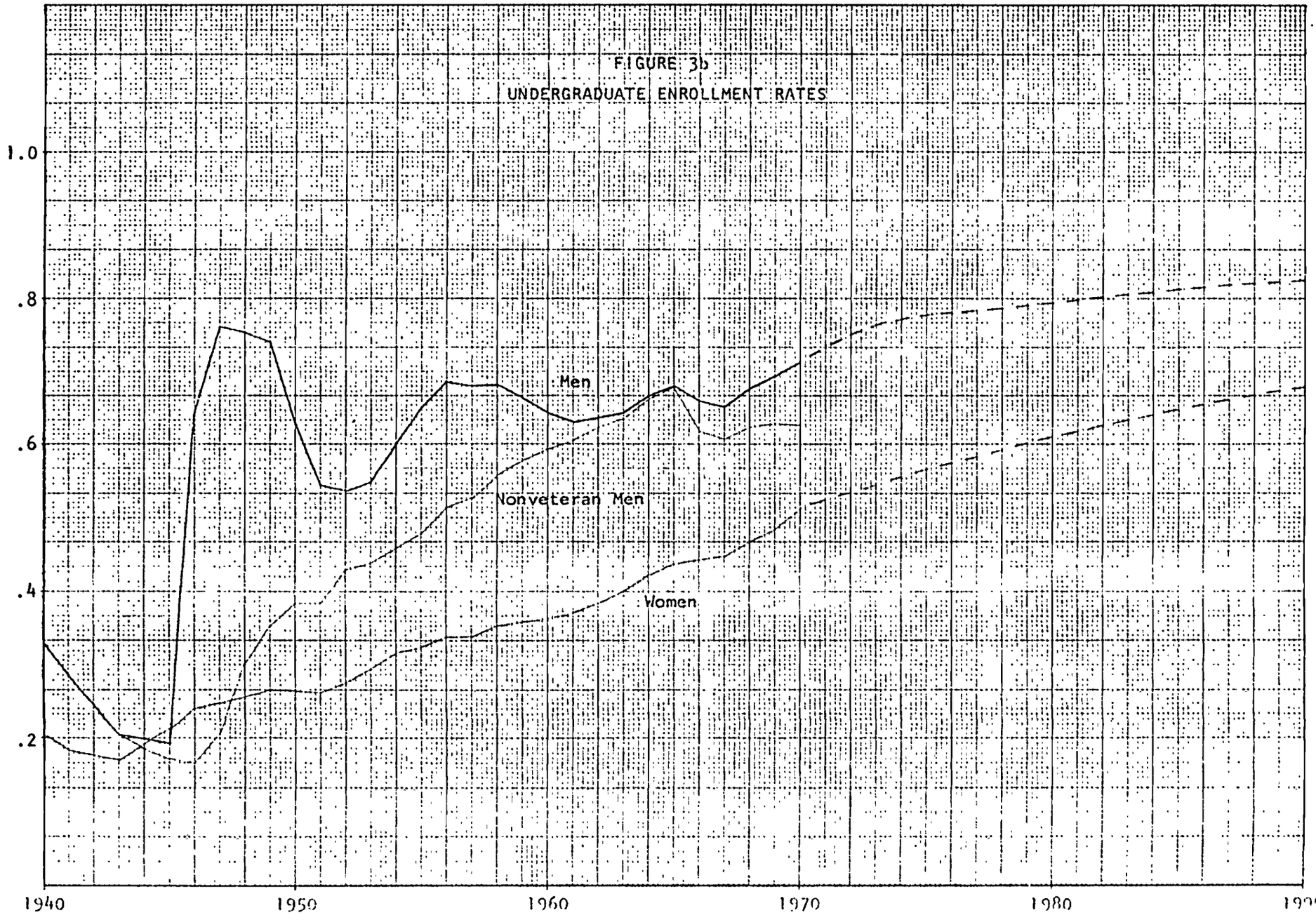


who delay college entrance for a year or more after graduation. If these students had been included, it appears that there would be close agreement between the college entrance rates and the survey results, since the proportion of men who enter late is higher than that for women [30].

Figure 3b gives a plot of the "undergraduate enrollment rates" for men and women. This rate is defined for each year as the ratio of undergraduate degree-credit enrollment to the total number of high school graduates in the previous four years.

As can be seen from Figures 3a and 3b, both the college entrance rates and the undergraduate enrollment rates for women have been increasing consistently since World War II at a rate of about 1% per year. The corresponding rates for men have fluctuated in a wild manner. A close examination of the graphs will reveal that the fluctuations are of two kinds: (1) dips during wartime which coincide with high draft calls and their attendant high enlistment rates; (2) bulges which coincide with the return of large numbers of veterans to civilian life. For convenience the fluctuations of the first and second kinds will be referred to as "effects of the draft" and "effects of the G.I. Bills" respectively. Although this is an oversimplified and even misleading terminology, it will be seen that the dips and bulges in undergraduate enrollments for men have been almost proportional to the numbers of draftees in service in wartime and to the numbers of veterans in training in higher education.

Note that the slight dips and bulges in the graphs of the entrance and enrollment rates for women coincide with the larger dips and bulges in the rates for men. There is no evidence that the women's enrollment rates have been signif cantly affected by economic factors. If the economic recessions of 1948-49, 1957-58, and 1960-61 had any effect upon enrollments,



it is not evident from the entrance rates for women. Perhaps there may have been a large number of women who would otherwise have entered college during the recessions if it were not for financial reasons; if so, then there must have been an almost equally large number of women who elected to attend college during these periods (perhaps because they could not find suitable employment) although they would not otherwise have done so.

With the increasing availability of open-access institutions and the gradual erosion of the earlier barriers to college attendance, including the academic barrier, the college entrance rates can be expected to continue to rise. For men there should be a slight bulge in the entrance rates for several years as the Vietnam veterans return to the campuses under the G. I. Bill. Eventually, of course, the rates for both men and women must level off at a value less than 1.0, unless large numbers of foreign students should eventually inflate the entrance rates to a far greater extent than they do today. At the present time, foreign students comprise about 1% of the total undergraduate enrollment.

In 1970, the college entrance rate for men was 67%; for women it was 54%. After the post-Vietnam War period, future increases in the male entrance rates should be at a very slow rate unless some large-scale system of grants or some other policy is enacted to attract those high school graduates who would not otherwise enter college. In the absence of such a program, the rate for men might be expected to reach about 80% by the year 2000. It seems likely that there will be a further closing of the gap between the male and female entrance rates from its present 13% to perhaps around 5% by 2000, in which case the female rates would reach close to 75% by the year 2000. In the analysis below it is assumed that, if one accounts for wartime effects properly, the entrance rates would

approximately follow logistic growth curves. The asymptotes of these curves will be taken to be 0.85 and 0.80 for men and women respectively, but this specification of asymptotes is not critical (except for making very long-term projections) as will be discussed below.

Table 3 gives the number of veterans who entered training under one of the G.I. Bills for each year from 1947 to 1970. These numbers, which are listed separately in the table for World War II, the Korean War, and the Vietnam War, will be denoted by $E_2(t)$, $E_k(t)$. and $E_v(t)$ in the analysis below. (It is regrettable that these yearly data on the number of veterans entering training include veterans in all training programs rather than just those who enroll in institutions of higher education. However, the inclusion of these other veterans in the data should make little difference in the assessment of the effects of G.I. Bills upon first-time enrollments, because the numbers of veterans entering college should be approximately proportional to the numbers given in the table for each war.) Table 3 also gives the number of inductions during the calendar year for each year t during the Korean and Vietnam Wars. These numbers will be denoted by $I_k(t)$ and $I_v(t)$ respectively.

In the analysis of the data in Table 3 the basic underlying assumption is that, if one accounts for the wartime effects upon first-time enrollment, then there is an underlying entrance rate for men which follows a consistent pattern that closely parallels the pattern for the women's entrance rates. We shall denote this hypothetical underlying entrance rate for men for year t by $\pi(t)$ and assume that this rate increases according to a logistic growth curve:

$$\pi(t) = \frac{\gamma}{1 + e^{-(\alpha+\beta t)}} .$$

This amounts to saying that, had it not been for the wars, we could analyze the data using the nonlinear regression model

$$F(t) = \pi(t)\, H(t) + e(t),$$

where $e(t)$ denotes the deviation of $F(t)$ from the underlying pattern during the year t.

In order to account for the effects of the wars upon first-time enrollment, we incorporate the numbers of veterans entering training and the numbers of wartime inductions into the model as follows:

$$F(t) = \pi(t)\, H(t) + \beta_2 E_2(t) + \beta_3 E_k(t) + \beta_4 E_v(t) + \beta_5 I_k(t) + \beta_6 I_v(t) + e(t),$$

where α, β, β_2, ..., β_6 are parameters to be estimated from the data. Note that the parameters β_2, β_3, and β_4 can be interpreted roughly as the proportions of the veteran enrollments for the three wars that are not accounted for by the underlying growth in enrollment rates. Therefore, these coefficients give a rough indication of the effectiveness of the G. I. Bills in attracting students who might not otherwise enroll in college.

The parameter γ in the growth curve $\pi(t)$ is taken as 0.85, as was discussed above. Any other specification of γ between 0.8 and 1.0 (or even replacing the logistic growth curve by a linear function of t) leads to approximately the same projections as those given below for the next ten years and to approximately the same estimates of the parameters β_2, ..., β_6. Alternatively, one might consider trying to estimate γ from the data, but the goodness of such estimates seems to depend critically on how well the statistical model fits the data. The woeful past experience of those who have estimated asymptotes for logistic growth curves to predict population sizes (e.g., see Chapter 7 of [44])

leads us to prefer a hopefully somewhat educated guess for γ to a more mathematically sophisticated estimate.

If one sets $t = 0$ for the year 1960, the least-squares estimates of the parameters and their standard errors are as follows:

Parameter	α	β	β_2	β_3	β_4	β_5	β_6
Estimate	.888	.037	.055	.123	.120	-.055	-.185
Standard error	.061	.016	.017	.041	.073	.038	.089

The large difference between the estimates of β_2 and β_3 may seem puzzling at first, but this difference must be viewed in the light of two important factors: (1) most of the World War II veterans who entered training in institutions of higher education had done so before the fall term of 1947; (2) a much larger proportion (50%) of the trainees under the Korean G. I. Bill entered college or university training as compared with the World War II veterans, of whom only 29% enrolled in colleges and universities. (See [26].) A more detailed analysis of the relative effectiveness of the G. I. Bills will be given in the section entitled "Undergraduate Enrollment."

Table 4 exhibits the decomposition of male first-time enrollment for each year into its estimated components according to the model. For example, for the year 1970 the estimated underlying entrance rate is such that, if the Vietnam War had not affected the first-time enrollment, one would have anticipated a first-time enrollment of 973,000 based upon the number of high school graduates in 1970. The estimated net adjustment for the Vietnam War was an increase in enrollment of 40,000 students. The residual of -28,000 is the part of the 1970 male first-time enrollment that is still

Table 4

Estimated Effects of Wars and G. I. Bills
upon Male First-time Degree-credit Enrollment
(All data are in thousands)

Year	Male F(t)	Leading term	World War II G. I. Bill effect	Korea effects			Vietnam effects			Residual
				G.I. Bill	Draft	Net	G.I. Bill	Draft	Net	
1947	400	263	128							9
1948	369	292	68							9
1949	355	298	55							1
1950	318	306	40							-28
1951	279	305	30		-30	-30				-26
1952	322	313	2	6	-24	-18				25
1953	343	319	1	37	-26	11				12
1954	384	346		58	-14	44				-7
1955	416	368		60	-8	51				-4
1956	443	392		54		54				-3
1957	442	405		38		38				-2
1958	465	429		27		27				9
1959	488	471		13		13				5
1960	540	541		5		5				-6
1961	592	583		3		3				6
1962	598	579		2		2				18
1963	604	596								8
1964	702	705								-3
1965	829	832								-3
1966	787	848					37	-71	-33	-27
1967	814	859					38	-42	-4	-41
1968	925	873					51	-55	-4	56
1969	954	918					65	-54	11	25
1970	985	973					71	-30	40	-28

not explained by the estimated relationship between first-time enrollment and the other variables in the model.

The residual pattern shows that the model has not fit the enrollments for the last five years as well as it has for the preceding 18 years. This lack of fit may be due in part to the change in draft policies with the advent of the lotteries during the last two years. (Another reason will be given below.) The model clearly fits very well for the period 1947 to 1965. If the economic factors associated with recessions had any sizable effect upon male enrollments during periods of recession, this would show up in the residual pattern, but no such effect is apparent.

Another reason for exhibiting this table is that it provides some indication of the post-war enrollment bulge to be anticipated due to the effect of the Vietnam G. I. Bill. Note that the net adjustments for wartime effects during the Vietnam War are running close to the corresponding adjustments for the Korean period, although draft calls for the Vietnam period have on the average run about 3/4 as high as those during the Korean War.

The projections of male first-time degree-credit enrollment are given in Table 5. These projections result from first combining the projections of high school graduates given earlier with the projected underlying entrance rates derived from the estimates of α and β above. The resulting estimates are then adjusted by adding the following estimates of the net effects of the Vietnam War upon first-time male enrollment for the next five years:

Year	1971	1972	1973	1974	1975
Adjustment	40,000	40,000	30,000	20,000	10,000

Table 5

Projections of College Entrance Rates and
First-time Degree-credit Enrollment: Fall, 1971-2000
(All data are in thousands)

Year	First-time degree-credit enrollment			College entrance rate	
	Men	Women	Total	Men	Women
1971	1060	840	1900	.693	.546
1972	1100	890	1990	.697	.555
1973	1130	920	2050	.695	.563
1974	1160	960	2120	.694	.572
1975	1190	1000	2190	.693	.580
1976	1200	1020	2220	.692	.588
1977	1230	1040	2270	.696	.596
1978	1270	1080	2350	.701	.604
1979	1300	1100	2400	.705	.611
1980	1290	1100	2390	.710	.618
1985	1160	1010	2170	.730	.652
1990	1250	1110	2360	.747	.680
1995	1450	1290	2740	.763	.704
2000	1650	1480	3130	.776	.723

The corresponding projections of first-time degree-credit enrollment for women result from first fitting a logistic growth curve with asymptote $\gamma = 0.80$ to the observed entrance rates for women from 1947 to 1968 in the same manner as high school graduation rates were fitted earlier. The estimated values of α and β were .075 and .049 respectively. However, the fitted curve lies somewhat below the actual ratios for the last three years. A contributing cause to this lack of fit was the reclassification of students by degree-credit status in New York beginning in 1968. In 1965 the total number of New York students reported as being enrolled in programs not chiefly creditable toward a bachelor's degree was 94,464; in 1968, it was only 6,517, whereas the enrollment in this category rose sharply for the rest of the nation. Thus, much of the jump in degree-credit enrollments in New York between 1967 and 1968 resulted from a change in definitions, and this jump was large enough to have a noticeable effect upon the national enrollment. To account for this change (which also contributed to the lack of fit of the model for analyzing the male enrollments), the values of α and β in the fitted logistic growth curve were adjusted so that the curve would pass through the observed entrance rate for women for 1970 and would have the same slope as the fitted curve at $t = 1970$. The resulting values of α and β used in making the projections were .202 and .051.

The projected entrance rates given in Table 5 are also indicated by dotted lines in Figure 3a. These rates rise slowly for both men and women, reaching 71% for men and 62% for women in 1980, and 78% for men and 72% for women in 2000.

These projections of first-time degree-credit enrollment are slightly lower than those provided by the Office of Education in [22] for the years

up to 1978. Their projection for 1978 is 2,539,000, which exceeds the projection given here by about 8%, whereas their projection of high school graduates for 1978 exceeds ours by about 3%. Their projections are "based on the assumption that the first-time enrollment, expressed as a percentage of the population averaging 18 years of age, will follow the 1958-68 trend to 1978 in each category of enrollment." Their technique of using linear extrapolation for making short-term projections could be significantly improved upon by taking into account the wartime effects upon male enrollments.

RETENTION RATES AND BACHELOR'S DEGREES

Although the proportion of students graduating from high school has risen at a remarkable rate and despite the fact that the proportion of these high school graduates who enter college continues to rise, there has been virtually no change in the retention rates for undergraduate students over the last 20 years. This conclusion has been reached by others in the past on the basis of longitudinal studies of students within the same institution. Dorothy Knoell, in [15], summarized the research on attrition of undergraduates up to 1964 as follows:

> The average rate of attrition has been found to be quite stable over the past 40 years in a considerable number and variety of studies; however, a considerable amount of variability has been found among different types of colleges studied at any one time, particularly between public and private institutions.

For a recent survey of the research on attrition, see Chapter 5 of [8].

In general, the research tends to support the generalization that students who attend the more selective colleges are less likely to drop out before graduation. Thus, the public institutions tend to have higher attrition rates than the private institutions, and the junior colleges tend to have higher attrition rates than four-year institutions. It is this latter factor that leads some people to conjecture that the overall attrition rate for all students must be rising as the proportion of students who enter the junior colleges increases, but this study does not support that conclusion. Perhaps the reason that the overall attrition rate for all institutions has not risen is that financial need has lost some of its earlier influence upon attrition as the general affluence of the population has risen and more low-tuition, open-access institutions

have become available.

To measure the holding power of the colleges and universities at the undergraduate level on the basis of the available national data, one can use the ratio of the number of returning undergraduate students during year t to the number of students who did not graduate from college during the previous year. Symbolically, we define the "retention rate" $R(t)$ for year t to be

$$R(t) = \frac{U(t) - F(t)}{U(t-1) - B(t)},$$

where $U(t)$ denotes the undergraduate opening fall degree-credit enrollment during year t (as before, this enrollment category includes the first-professional and graduate extension students), $F(t)$ is the corresponding first-time enrollment, and $B(t)$ denotes the number of bachelor's and first-professional degrees during the academic year ending in year t.

Table 6 gives the retention rates and the yearly number of bachelor's and first-professional degrees for the period 1950-68. From the table we see that the combined retention rate for men and women has been close to 90% throughout this period. Of course, more than 10% of the undergraduates "drop out" of college from one year to the next, but some of these students are replaced by enough of the earlier dropouts to keep the overall retention rate close to 90%.

The higher retention rates for men during the period 1952-56 is surely related to student deferments from the draft during the Korean War and to the influx of veterans entering school under the Korean G. I. Bill. After allowance is made for this, there seems to be a very slight time trend toward even higher retention rates. However, this may also be due to the everchanging means (and definitions) in gathering the data, or it might even be due to a trend toward increased enrollment of first-time

Table 6

Bachelor's and First-professional Degrees,
Retention Rates, and College Graduation Rates: 1950-69
(All data are in thousands)

Year	Bachelor's & first-prof. degrees		Retention rate		Bachelor's degrees		$\frac{b(t)}{F(t-4)}$		Graduation rate	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
1950	329	103	.872	.838	292	100	.584	.508	---	---
1951	278	104	.861	.833	240	101	.600	.523	---	---
1952	226	104	.893	.868	191	102	.518	.515	.488	.519
1953	200	103	.891	.869	166	101	.468	.507	.456	.510
1954	187	105	.951	.894	155	101	.489	.518	.464	.512
1955	183	103	.946	.851	153	100	.550	.526	.513	.517
1956	199	111	.940	.891	169	107	.526	.507	.547	.524
1957	222	117	.900	.851	191	113	.557	.502	.578	.519
1958	242	122	.909	.866	210	118	.547	.486	.575	.503
1959	253	129	.831	.852	221	126	.531	.496	.554	.508
1960	254	138	.877	.854	219	134	.494	.487	.510	.505
1961	254	144	.881	.848	222	141	.502	.500	.505	.509
1962	261	157	.901	.869	227	153	.488	.494	.498	.513
1963	273	174	.913	.883	238	170	.488	.509	.499	.529
1964	298	201	.914	.892	262	196	.485	.510	.507	.542
1965	318	217	.909	.879	278	211	.470	.495	.491	.522
1966	329	222	.890	.889	299	221	.500	.512	.506	.520
1967	353	237	.906	.893	323	236	.535	.534	.537	.540
1968	391	276	.910	.889	358	275	.510	.526	.541	.562
1969	444	320	.890	.869	411	318	.496	.519	.535	.559

students at times other than the beginning of the fall term.

This apparent stability in retention rates suggests that one should be able to build a mathematical model which would predict the flow of students through the system from first-time enrollment to graduation with considerable success. Unfortunately, the available data on enrollment by level is so incomplete at the present time that, although various models can be devised to fit the available data, the verification of these models awaits future data. This superficial stability in the attrition rates as defined above may in fact be a statistical happenstance from the counterbalancing of genuine trends in attrition rates by level due to such factors as steadily increasing enrollments, economic factors, a trend toward first-time enrollment during the summer term, etc. Further data on enrollments by level and a more detailed analysis of the effects of other factors upon enrollments may very well show that our tentative conclusion about the consistency of attrition rates is premature.

Further evidence of the consistency of the attrition rates over time can be obtained by looking at the proportion of first-time students who eventually graduate from college. As an estimate of this proportion, the ratio of the number of bachelor's degrees to the number of first-time degree-credit students four years earlier can be used. These ratios are given in Table 6. For a better measure of the "graduation rate," one can replace the denominator in the ratios $b(t)/F(t-4)$ above by a weighted average of first-time enrollments that is more representative of the graduating class in year t. The weighted average chosen here was

$$w(t) = .6\,F(t-4) + .3\,F(t-5) + .1\,F(t-6).$$

The weights were motivated by consideration of data in [30] on the numbers of juniors and seniors in the fall of 1966 as compared with first-time

enrollments during preceding years. This choice is somewhat artificial; fortunately, the weighted averages are not very sensitive to the choice of weights.

As the consistency over time of the retention rates for women would suggest, the graduation rates for women have essentially remained unchanged from 1952 to 1962, fluctuating in a narrow band between 50% and 52%. Since 1962, the retention rates have risen slightly, and there has been a corresponding increase in the graduation rates. (In 1966, there was a reclassification of bachelor's degrees to include the five-year degrees in certain fields, but this inclusion apparently added less than 1% to the total.)

The graduation rates for men have also been higher in the last few years, apparently as a result of the increasing numbers of veterans attending college beginning in 1966. The student deferments from the draft may also have contributed to the increase, but if so, this would be in contrast to the corresponding period during the Korean War, when graduation rates dropped sharply despite the availability of student deferments.

Projections of numbers of bachelor's degrees are given in Table 7. The projections for women result from the assumption that the graduation rate will remain at 56% for the next two years, then drop to 55% until 1976, then remain at 54% after 1976. The graduation rates for men are taken to be 2% less than those for women for all years.

The NCES projections [22] of the numbers of bachelor's and first-professional degrees for the years 1970-79 are lower than those given here. Their projection for 1979 is 1,056,000 degrees, which is about 11% below the projection in Table 7. The reason for the large discrepancy is that the methodology behind the NCES projections does not allow for wartime effects upon degree production.

Table 7

Projections of Bachelor's and First-professional Degrees, Alternate Projections of Undergraduate Degree-credit Enrollment: 1970-2000
(All data are in thousands)

Year	Bachelor's degrees		Bachelor's and first-professional degrees		Undergraduate degree-credit enrollment (alternate projections)		
	Men	Women	Men	Women	Men	Women	Total
1970	427	331	462	333	3960	2870	6830
1971	436	344	472	346	4200	3060	7260
1972	465	368	504	370	4430	3260	7690
1973	494	394	534	396	4640	3440	8080
1974	514	423	556	425	4840	3610	8450
1975	544	450	589	452	5010	3770	8790
1976	572	475	619	477	5160	3920	9080
1977	581	487	629	489	5300	4070	9370
1978	597	508	646	510	5460	4210	9670
1979	612	528	662	530	5610	4340	9960
1980	622	544	673	547	5740	4440	10180
1985	670	596	725	599	5730	4440	10170
1990	604	549	654	552	5810	4550	10360
1995	662	608	716	611	6550	5220	11770
2000	764	709	827	713	7430	5990	13420

At first glance, there appears to be contradiction between our calculated retention rates and graduation rates. For men, the annual retention rate of 90% would seem to imply that the graduation rate should be approximately $(0.9)^4 = 0.66$, instead of 0.5. However, a large proportion of the students take more than four years to complete their bachelor's degrees. Also, one should recall that the term "undergraduate enrollment" as used here includes the first-professional students, many of whom take ten years or more to earn their degrees. A typical student working toward an M.D. would be counted in the undergraduate enrollment for 12 to 14 years. Finally, the calculation of $(0.9)^4$ represents a misinterpretation of the 90% figure as a "transition rate" (proportion advancing one year in educational attainment) rather than as a "return rate" (proportion returning for more work). The distinction is important, because among the entering freshmen of a certain year who return the following year, a large proportion will be returning as freshmen, having completed less than one year of academic work. As an indication of the number of returnees at the same level, in the opening fall enrollment of 1967 [19], there were 2,307,000 freshmen, but only 1,641,000 of these freshmen were enrolled in college for the first time.

The stability of the retention rates affords a convenient method of making short-term projections of undergraduate degree-credit enrollment. It follows from the definition of the retention rates $R(t) = [U(t)-F(t)] / [U(t-1)-B(t)]$ that

$$U(t) = F(t) + R(t)\,[U(t-1) - B(t)].$$

If we assume that the retention rates $R(t)$ will remain stable in the future at 88% for women and 90% for men (their average values for the past five years), then this recursion relation can be combined with the projections

of first-time enrollment and those of bachelor's and first-professional degrees to yield projections of undergraduate degree-credit enrollment. The resulting projections are given in Table 7.

This method of making projections, although appealing for short-term projections, is unsuitable for long-term projections since the errors of prediction are effectively compounded over time. The projections of undergraduate enrollment given in Table 1 result from another methodology that seems preferable for making long-term projections; this will be discussed in the next section. Although the two sets of projections are in close agreement for the next ten years, the differences between them widen in the 1980's and 1990's.

UNDERGRADUATE ENROLLMENT

During the last decade, undergraduate degree-credit enrollment rose almost 120% as the surge of postwar babies, who had swamped the high schools in the early 1960's, moved on to the college campuses, swelling enrollments in the middle and late 1960's at a rapid rate. As an indication of how rapidly the high schools and colleges had to expand during this period, the number of high school graduates increased by 37% in the two-year period from 1963 to 1965, and undergraduate enrollment rose by 52% between 1963 and 1968 despite the pronounced negative effect of the Vietnam War upon male undergraduate enrollment during this period.

As a measure of how rapidly undergraduate enrollment has risen relative to the number of high school graduates, the "undergraduate enrollment rate" $r(t)$ for any year t is defined to be the ratio of opening fall undergraduate degree-credit enrollment (which includes first-professional and graduate extension enrollments) to the total number of high school graduates over the preceding four years; symbolically

$$r(t) = U(t) \,/\, \Sigma_{k=0}^{3} H(t-k),$$

where $H(t)$ is the number of high school graduates in year t.

Plots of the undergraduate enrollment rates by sex for the years 1940-1970 were given in Figure 3b. For women, these rates have been increasing consistently since World War II at a linear rate of about 1% per year. The corresponding rates for men have fluctuated wildly as a result of the wartime effects upon undergraduate enrollments. The undergraduate enrollment rates for "nonveteran men" indicated in Figure 3b result from subtracting the estimated number of veterans who are attending school under a G. I. Bill at the undergraduate level from the undergraduate degree-credit enrollment.

It might be argued that the enrollment rates defined here are misleading because a sizable percentage of undergraduate students were graduated from high school more than four years ago; these percentages were about 30% for men and 20% for women in 1966 according to estimates derived from Bureau of the Census data [30]. For this reason and others, one might consider replacing the denominator in the definition of the enrollment rate by a weighted average of the numbers of high school graduates over a longer time period.

To do this, one can use data from the Bureau of Census report cited above to derive estimates of the composition of opening fall undergraduate enrollment in 1966 by year of graduation from high school. (See Table 8.) The resulting percentages of high school graduation classes that were enrolled as undergraduates in 1966 make a puzzling pattern, even considering that 1966 was the first year that the Vietnam War had a marked effect on enrollment in higher education. Table 8a gives the corresponding percentages for age groups in the three-year period 1964-1966; these are derived from [36]. The estimates of percentages for high school graduates for 1965 given in Table 8b result from applying some admittedly crude assumptions to the percentages in Table 8a. Although no attempt will be made here to defend these estimates, perhaps they provide an indication of the actual distribution.

Using the percentages in Table 8b, one might construct an undergraduate male enrollment index for each year t by setting

$$I(t) = U(t) / [.60\ H(t) + .55\ H(t-1) + \cdots + .04 \sum_{k=6}^{19} H(t-k)].$$

This index would then weight the number of high school graduates for each year according to their estimated 1965 percentages. When plotted against time, these indices, as well as the corresponding ones for women, behave like the simpler enrollment rates $r(t)$ defined above, i.e., the same peaks

Table 8

Percentage of High School Graduates Enrolled as Undergraduates by Year of Graduation: 1966

	Year of graduation from high school					
	1966	1965	1964	1963	1962	1947-61
Men	52	36	53	48	28	6
Women	42	27	37	29	11	2

Table 8a

Percentage of Age Groups Enrolled as Undergraduates: 3-year Average, October, 1964-66

	Age as of October 1										
	16	17	18	19	20	21	22	23	24	25-29	30-34
Men	0.3	7.0	37.9	41.3	38.3	31.1	15.3	10.4	8.0	4.8	1.8
Women	0.2	8.0	31.4	26.6	21.4	15.3	4.7	2.6	2.0	1.5	0.9

Table 8b

Percentage of High School Graduates Enrolled as Undergraduates by Year of Graduation: 1965

	Year of graduation from high school						
	1965	1964	1963	1962	1961	1960	1946-59
Men	60	55	50	44	20	15	4
Women	46	38	31	28	9	4	2

and valleys appear for the male and female indices as for the enrollment rates in Figure 3b. Thus we reject the indices above and others of a similar nature in favor of the simpler enrollment rates.

In the analysis below it will be assumed that the undergraduate enrollment rates will eventually level off at about 85% for men and 80% for women. These choices of limiting values, which are not critical in the analysis except for making long-term projections, are the same as those assumed earlier for the college entrance rates; this is motivated in part by a comparison of Figures 3a and 3b, which show that the undergraduate enrollment rates have been of the same order of magnitude as the college entrance rates in the past. For men, the undergraduate enrollment rates have tended to be slightly higher than the college entrance rates, whereas for women the situation has been reversed. In the future, as more women enter the first-professional fields, perhaps the enrollment rates for both sexes will more closely approximate the college entrance rates. With the 1970 undergraduate enrollment rates at 71% for men and 51% for women, this assumes an eventual increase of about 20% over the current rate for men and 60% for women. Increases of this order of magnitude are well within reason since, in 1969, only 44% of the 18- and 19-year-old men were enrolled in college, and only 45% of the 20- and 21-year-old men; for women, the corresponding percentages were 34% and 24% [37].

The consistent rise in the enrollment rates for women since World War II, except for a slight dip during the early part of the Vietnam War, leads us to conjecture that, if it were not for those factors that affect male enrollment without affecting female enrollment at the same time, the enrollment rates for men might also have risen at a steady rate. In particular, this consistency

for women provides some justification for ignoring economic factors (except G. I. Bills) in our analysis below, since the combined effects of economic factors upon undergraduate enrollment seem to be accounted for by the time trends in the enrollment rates. A close analysis of Figure 3b shows that the enrollment rates for women have not been noticeably affected by periods of economic recession since World War II.

The analysis of male undergraduate enrollment will incorporate data on veterans and draft calls in a manner analogous to that used in analyzing first-time enrollment. Table 9 gives the number of veterans attending institutions of higher education under G. I. Bills as of November 30 of each year from 1947-1967. These numbers, which are listed separately in the table for World War II, the Korean War, and the Vietnam War, will be denoted by $V_2(t)$, $V_k(t)$, and $V_v(t)$ in the analysis below.

As was discussed earlier, the military buildups in Korea and Vietnam began in late 1950 and late 1965 respectively. Thus, the effects of the wartime draft upon opening fall enrollment would begin to appear in 1951 for the Korean War and in 1966 for Vietnam. The numbers given in the columns headed "Wartime draftees in service" in Table 9 for these two years are the numbers of inductions during the preceding fiscal year; e.g., for the fiscal year ending June 30, 1951, there were 587,444 inductions. The entries for the other wartime years 1952-1955 and 1967-1970 are the total numbers of inductions over the preceding two fiscal years. The resulting numbers for the years during the Korean and Vietnam wars will be denoted by $D_k(t)$ and $D_v(t)$ respectively in the analysis to follow.

In analyzing the data in Table 9 the basic underlying assumption is that, if one accounts for the wartime effects in an appropriate way, then there is an underlying undergraduate enrollment rate for men which follows

Table 9

Male Undergraduate Degree-credit Enrollment, Veterans and Wartime Draftees: 1947-1970
(All data are in thousands)

Year	Male undergraduate degree-credit enrollment	Veterans in training in higher education			Wartime draftees in service	
		WW II	Korea	Vietnam	Korea	Vietnam
1947	1512	1236				
1948	1555	1051				
1949	1562	898				
1950	1392	609				
1951	1237	411			587	
1952	1224	240	36		968	
1953	1255	143	146		942	
1954	1400	82	293		829	
1955	1567	44	417		482	
1956	1729	2	481			
1957	1798	1	452			
1958	1879		386			
1959	1920		275			
1960	2001		174			
1961	2131		103			
1962	2283		57			
1963	2439		29			
1964	2659		14			
1965	2958					
1966	3126			249		343
1967	3326			272		642
1968	3595			335		646
1969	3760			432		614
1970	3960			590		476

a consistent pattern paralleling the pattern for women. We shall denote this hypothetical underlying enrollment rate for year t below by $\rho(t)$ and assume that this rate increases according to a logistic growth curve:

$$\rho(t) = \frac{\gamma}{1 + e^{-(\alpha + \beta t)}} .$$

This amounts to saying that, had it not been for the wars, we could analyze the data using the nonlinear regression model

$$U(t) = \rho(t) \Sigma_{k=0}^{3} H(t-k) + e(t)$$

where $e(t)$ denotes the "disturbance" of $U(t)$ from the underlying pattern during the year t.

In order to account for the effects of the wars upon undergraduate enrollment, we shall incorporate the numbers of wartime draftees and veterans into the model as follows:

$$U(t) = \rho(t) \Sigma_{k=0}^{3} H(t-k) + \beta_2 V_2(t) + \beta_3 V_k(t) + \beta_4 V_v(t) + \beta_5 D_k(t) + \beta_6 D_v(t) + e(t)$$

where α, β, β_2, $\cdots$, β_6 are parameters to be estimated from data. Note that the parameters β_2, β_3, and β_4 can be interpreted roughly as the proportions of the veteran enrollments for the three wars that are not accounted for by the underlying growth in enrollment rates. Therefore these coefficients give a rough indication of the effectiveness of the G. I. Bills in attracting students who might not otherwise enroll in college.

The parameter γ in the growth curve will be set equal to 0.85 to correspond with our notion discussed earlier that the enrollment rates for men will eventually level off at about 0.85. As in the analogous situation for high school graduation rates, fitting a logistic growth curve over the time interval under consideration here almost amounts to fitting a

line and only long-term projections are affected to a significant degree by the specification of γ.

If one takes $t = 0$ for the year 1960, the least-squares estimates of the parameters and their standard errors are as follows:

Parameter	α	β	β_2	β_3	β_4	β_5	β_6
Estimate	.898	.080	.704	.748	.222	-.065	-.390
Standard error	.033	.009	.057	.069	.108	.034	.073

As was pointed out above, t he estimates of β_2, β_3, and β_4 are of interest in assessing the effectiveness of the G. I. Bills. The estimated values of these parameters suggest that the World War II and Korean G. I. Bills were almost equally effective in attracting students who might not otherwise enroll in college, whereas the Vietnam G. I. Bill has been much less effective. However, in making these comparisons, one must somehow adjust for the differences in undergraduate enrollment rates at the beginning of the wartime periods. There are other complicating factors which make comparisons difficult. The Vietnam G. I. Bill (Public Law 89-358) was passed on March 3, 1966. Perhaps many potential students either volunteered for the draft in 1966 or effectively let themselves get drafted by not applying for student deferments in order to take advantage of the benefits under the new bill. The sharp drop in the nonveteran undergraduate enrollment rate in 1966 (see Figure 3b) and the jump in male first-time enrollment two years later supports this conjecture. Also, the amount of support under the new G. I. Bill has been changed twice. For a single veteran, the payment increased from $100 per month in 1966 (which was less

than the rate of pay under the Korean bill) to $130 in October 1967; then in February 1970 it was raised again to $175 [7]. Perhaps this latter increase will attract some of the veterans who have elected to bypass the earlier rates.

Table 10 exhibits the decomposition of male undergraduate enrollment for each year t into its estimated components according to the model. For example, for the year 1968, the estimated underlying enrollment rate is such that, if the Vietnam War had not occurred, one would have anticipated an undergraduate enrollment of 3,754,000 based upon the number of high school graduates from 1965 to 1968. The estimated net adjustment for the Vietnam War was a reduction in undergraduate enrollment by about 178,000. The residual of 19,000 is the part of the 1968 undergraduate enrollment that is not "explained" by the estimated relationship between undergraduate enrollment and the other variables in the model.

By comparing the net adjustments for wartime effects during the Vietnam War with those for the corresponding period of the Korean War, one sees that the Vietnam War has had a much more pronounced effect upon enrollments, perhaps partly because of the rise in the educational level of the draftees between 1950 and 1965. This difference between the effects of the two wars can also be seen in the plot of the enrollment rates for nonveteran men in Figure 3b. Whereas the rates were barely affected by the Korean War, there was a sharp drop in the rates in 1966 and 1967, coinciding with the accelerated troop buildup for Vietnam. These rates can be expected to rise as the number of draft calls goes down. Judging from the effect of the G. I. Bill upon enrollments after the Korean War, one can expect an enrollment bulge for the next several years as the additional numbers of veterans attending school under the G. I. Bill more

Table 10

Estimated Effects of the Draft and G. I. Bills
upon Male Undergraduate Degree-credit Enrollment
(All data are in thousands).

Year	Male U(t)	Leading term	World War II G. I. Bill effect	Korea effects			Vietnam effects			Residual
				G.I. Bill	Draft	Net	G.I. Bill	Draft	Net	
1947	1512	699	870							-57
1948	1555	788	740							27
1949	1562	872	632							58
1950	1392	956	429							7
1951	1237	1020	289		-38	-38				-35
1952	1224	1066	169	27	-63	-36				25
1953	1255	1111	101	109	-61	48				-5
1954	1400	1174	58	219	-54	165				3
1955	1567	1258	31	312	-31	281				-3
1956	1729	1359	1	360		360				8
1957	1798	1469	1	338		338				-10
1958	1879	1577		289		289				13
1959	1920	1705		206		206				10
1960	2001	1880		130		130				-9
1961	2131	2089		77		77				-34
1962	2283	2271		43		43				-30
1963	2439	2430		22		22				-12
1964	2659	2628		10		10				21
1965	2958	2917								41
1966	3126	3232					55	-134	-78	-28
1967	3326	3545					60	-250	-190	-29
1968	3595	3754					74	-252	-178	19
1969	3760	3875					96	-239	-144	29
1970	3960	4030					131	-186	-55	-15

than compensate for the enrollment losses due to the draft.

The projections of male undergraduate degree-credit enrollment in Table 1 result from combining the projections of high school graduates given earlier with the projected underlying enrollment rates derived from the estimates of α and β given above. The resulting estimates of undergraduate enrollment are then adjusted by using the following estimates of the net effects of the Vietnam War upon undergraduate enrollment for the next 6 years:

Year	1971	1972	1973	1974	1975	1976
Adjustment (in thousands)	0	50	70	80	70	50

After 1976, the adjustment is reduced by 10,000 per year until it reaches zero in 1981. These adjustments are much lower than the estimated net effects for the corresponding period after the Korean War because (1) the participation rate under the new G. I. Bill has been lower (but the change in the pay rate in 1970 may change this), (2) the draft calls during the Vietnam War have been lower on the average so that the aftereffect of the return of the veterans can be expected to be lower. The choice of these adjustments was also motivated by the choice of the adjustments to first-time enrollments given earlier. Clearly, the adjustments chosen depend upon the assumption that the number of draft calls will continue to be reduced in the future.

The corresponding projections of undergraduate enrollment for women result from fitting a logistic growth curve with asymptote $\gamma = 0.80$ using the observed enrollment rates for women from 1947 to 1970 in the same manner as the college entrance rates were fitted earlier. The

estimated values of α and β were -.121 and .056 respectively; using the same type of adjustment as was used earlier to account for the effect of the reclassification of degree-credit enrollments in New York institutions in 1968, the estimates of α and β were changed to .008 and .057 respectively for purposes of making projections. The projected enrollment rates for both men and women are indicated by the dotted lines in Figure 3b.

The projections of undergraduate degree-credit enrollment in Table 1 run quite a bit higher than the NCES projections in [22]. The 1978 projection by NCES is for 5,040,000 men and 3,939,000 women. The projections in Table 1 exceed these projections by 12% for men and 5% for women.

GRADUATE ENROLLMENTS AND ADVANCED DEGREE PRODUCTION

Since a careful analysis of graduate enrollments and advanced degree production requires consideration of many factors, and the data on graduate enrollment by level permits a much more detailed analysis of the flow of graduate students than is possible at the undergraduate level, the analysis of graduate enrollments will be published as a separate study [10]. In that study, it is shown that there is a stability in retention rates at the graduate level over time analogous to that observed at the undergraduate level in this study. However, the uncertain effect upon the "first-time graduate enrollment rate" of the current reduced market for holders of advanced degrees makes projecting future graduate enrollments and degree production a chancy undertaking.

Three series of projections of graduate resident enrollment are provided in the study. They differ primarily in their assumptions about the future behavior of the first-time graduate enrollment rate. The projections given in Table 1 are the intermediate projections of the three. As an indication of the range of the three sets of projections, the high and low projections of graduate resident enrollment in 1980 are 2,070,000 and 1,570,000, as compared with the intermediate projection of 1,790,000 given in Table 1. The range in these projections is wide, but since the graduate resident enrollment will still only represent about 13-17% of total degree-credit enrollment in 1980, the differences among the three series only slightly affect the projections of total degree-credit enrollment in Table 1.

TOTAL DEGREE-CREDIT ENROLLMENT

Combining the projections for undergraduate and graduate enrollments, we obtain the projections of total degree-credit enrollment given in Table 1. According to these projections total degree-credit enrollment will continue to rise about one-half million students per year for the next five years. Then it will gradually level off, reaching a peak of about 12 million in 1982. There will be a slight decline in enrollments in the mid-1980's as the size of the college age group decreases. (See Figure 1.)

The NCES projections of total degree-credit enrollment to 1978 given in [22] are quite a bit lower than the projections given here. Their projection of 10,318,000 students for 1978 is almost exactly one million students below the projection in Table 1.

The NCES projections of total degree-credit enrollment are the sum of their separate projections for each of eight categories resulting from classifying enrollment by sex, by control (public and private), and by type of institution (2-year and 4-year). These projections are based upon the assumption that the ratio of enrollment in each category to the number in the 18-21 year age group will follow the 1958-68 trend to 1978. In applying this assumption they first project the 1978 enrollment rate in each category by extrapolating a regression line fitted to the ratios for the years 1958-68. Then, to project the ratios for the years between 1968 and 1978, they adjust the fitted lines to agree with the actual ratios for 1968; this amounts to estimating the yearly enrollment ratios for each category by interpolating between the 1968 ratios and the projected 1978 ratios. The projected ratios are then applied to the projected numbers in the 18-21 age group for each sex.

The main reason for the large differences between the NCES projections of total degree-credit enrollment and those given here is that the NCES methodology does not take into consideration that (1) the enrollment rates for men were inflated in the first part of the ten-year period 1958-68 by the presence of large numbers of Korean War veterans, and (2) they were deflated during the latter part of the ten-year period by the effects of the draft at the outset of the Vietnam War. Consequently, the regression lines fitted to the enrollment ratios for men for the years 1958-68 tend to underestimate the underlying growth rate.

Since the enrollment rates for women are less affected by wartime factors, the differences between our projections and the NCES projections of total degree-credit enrollment for women are not as great. The 1969 and 1970 data on total enrollment were not available when NCES released their projections; when these data are incorporated into their model, their projections to 1980 will agree more closely with the ones given in Table 1.

In 1967 the Bureau of Census published several series of projections of total enrollment by age and sex [35]. Their Series D-1 projections were based upon their Series D projections of sizes of age groups and their projections of the age-specific college enrollment rates by sex, which were derived according to the following assumption: "The proportion of enrollment at a given level of school would shift between 1963-65 and 1990 by the same overall per cent change as between 1950-52 and 1963-65." Since the projection period is twice as long as the base period, their projections are based on the assumption that the age-specific enrollment rates would increase about one-half as rapidly in the future as in the recent past.

Although their Series D projections of sizes of age groups have been reliable, their projections of enrollment have not. They projected a 22% increase in enrollment from 1966 to 1970 whereas the actual increase in opening fall degree-credit enrollment was over 30%. However, if their projections are adjusted upwards to bring their 1970 projections in line with the actual enrollments, the Bureau of Census projections would agree very closely with the projections derived here.

Donald Bridgman prepared a set of projections of enrollments and degree production for the Commission on Human Resources and Higher Education. (See [8, pp. 375-406].) His methodology for projecting enrollments is similar to that used by the Bureau of the Census except that he adjusts the Bureau of Census data on enrollments by age and sex to make the total enrollments by sex agree with the NCES opening fall enrollment surveys; also, he takes into account the fact that male enrollments in the late 1950's were inflated by the large number of veterans attending college under the G. I. Bill. Since his projections were based upon the data up to 1965, the distortions in the enrollment patterns beginning in 1966 resulting from the Vietnam War were not incorporated into his projections. Therefore, his projections can be interpreted as estimates of what the enrollments would have been if the Vietnam War had not affected them. It is interesting to note that Bridgman's projections for 1975 agree almost perfectly with the projections given in Table 1 for both undergraduate and graduate enrollments, although the projections in Table 1 anticipate an enrollment bulge in the mid-1970's on account of the Vietnam veterans.

Other writers have also indulged in making long-term enrollment projections for higher education despite the considerable evidence from

the past that such projections have almost always resulted in gross underestimates in just a few years. Allan Cartter and Robert Farrell gave an interesting discussion of past projections in their 1965 paper [4]. They attribute this consistent underestimation in part to the "traditional conservatism of educators which has made them 'bearish' in their prophecies." Apparently to guard against this, they gave a wide range of enrollment projections but, true to form, even the highest of their series of projections underestimated total enrollment by 1970.

In 1968, S. G. Tickton [29] projected that total enrollment would rise to 12,000,000 in 1980, of which 2,400,000 will be graduate and professional students. His estimate of total enrollment includes nondegree students, of which there were about 585,000 in 1968. Tickton does not specify the rationale behind his estimates except to indicate that he has considered the "trend toward going to college among the 18- to 24-year-olds." He goes on to say that his method allows for "a continued increase in the trend, and for more college-going among adults beyond college age as well."

In 1967, Ronald Thompson [28] gave projections of total enrollment (including nondegree students) up to 1975 which agree very closely with the NCES projections. He bases his projections upon a linear trend in the ratio of total enrollment to the number in the 18-21 year age group.

The most interesting recent work in analyzing and projecting enrollments in higher education is that of Joseph Froomkin in [9]. Basically, his approach involves estimating trends in college enrollment rates for high school graduates both by income quartile and by ability quartile, based upon very limited and somewhat suspect data from Project TALENT. After some delicate piecing together of information, he arrives at a model that

seems to fit the 1960-68 data quite well. Then, using NCES projections of numbers of high school graduates and his own projections of enrollment rates by income and ability quartiles, he gives projections of total degree-credit enrollment (in thousands) for the years 1969-76 which differ only slightly from the projections given in Table 1. However, his breakdown of total enrollments by level yields projections of graduate enrollments that are much lower than those given in Table 1. His methodology does not account for wartime effects upon enrollment.

PREBACCALAUREATE AND NONDEGREE-CREDIT ENROLLMENT

The historical data on undergraduate degree-credit enrollment in Table I are somewhat misleading in that they include both graduate extension and first-professional students. A more appropriate breakdown of enrollments by level was provided for in the 1968 NCES opening fall enrollment survey [20] when the institutions were asked to combine the graduate extension and postbaccalaureate first-professional students with the graduate resident students to yield a total postbaccalaureate enrollment. The remaining enrollment in the undergraduate category under this breakdown will be referred to here as the "prebaccalaureate enrollment." Estimates of prebaccalaureate enrollment for the years 1960-70 are given in Table II.

Table II also gives estimates of "nondegree-credit enrollment" for the years 1960-70. Students included in this category are enrolled in undergraduate occupational programs that are not chiefly creditable toward a bachelor's degree. Nondegree-credit enrollment has been rising at a remarkable rate for the last several years in conjunction with the rising popularity of the occupational programs in the junior colleges. The table indicates a doubling of enrollments in occupational programs between 1963 and 1968, but the data in the table are highly suspect and cannot be accepted at face value. A closer examination of the data suggests that the table understates the actual growth of enrollments in this category during the last five years.

The data for the years 1960-68 are NCES estimates from [22] that may be so inconsistent as to distort the growth of enrollments in this category. Before 1963, the data on nondegree-credit enrollments were not

Table 11

Prebaccalaureate and Nondegree-credit Enrollments by Sex, Enrollments in Two-year Institutions, 1960-1970, with Projections to 2000 (All data are in thousands)

Year	Prebaccalaureate enrollment			Nondegree-credit enrollment			Enrollment in 2-year institutions	
	Men	Women	Total	Men	Women	Total	Total	Nondegree
1960	1957	1246	3270	147	59	206	617	166
1961	2131	1354	3485	128	58	186	666	148
1962	2299	1490	3789	155	74	229	774	184
1963	2475	1629	4104	183	89	271	845	220
1964	2703	1809	4512	216	114	330	989	278
1965	3035	2043	5079	255	139	395	1173	332
1966	3226	2265	5490	279	183	462	1326	381
1967	3460	2472	5932	311	209	520	1513	437
1968	3781	2695	6476	359	226	585	1792	503
1969	3970	2840	6810	390	250	640	1942	552
1970	4200	3100	7300	430	290	720	2210	630
				Projections				
1971	4505	3303	7807	485	322	807	2428	710
1972	4829	3518	8346	543	357	900	2660	794
1973	5100	3717	8818	592	388	981	2862	867
1974	5345	3916	9261	636	420	1057	3053	936
1975	5554	4102	9656	674	450	1124	3222	998
1976	5721	4270	9991	704	477	1181	3365	1050
1977	5874	4425	10299	732	502	1233	3497	1097
1978	6030	4576	10606	760	526	1286	3629	1145
1979	6170	4711	10881	785	547	1332	3747	1187
1980	6268	4814	11082	803	564	1367	3833	1218
1985	5879	4664	10544	733	540	1273	3601	1133
1990	5828	4758	10587	723	555	1278	3618	1138
1995	6697	5591	12288	880	688	1568	4348	1402
2000	7629	6494	14123	1048	832	1880	5134	1686

gathered in the opening fall enrollment surveys, so that the data before 1963 may not be comparable with the later data. The only data in the table that result from actual counts in the opening fall enrollment surveys are those for 1963-65 and 1968. Unfortunately, even these data appear to be incommensurate on account of a reclassification of the degree-credit status in New York institutions between 1965 and 1968. The reported total nondegree-credit enrollment in New York dropped from 94,464 in 1965 to 6,517 in 1968, whereas enrollment in this category almost doubled for the rest of the U. S.

To make the 1963-65 data more comparable with the 1968 data, an attempt was made to estimate what the nondegree-credit enrollment would have been for the years 1963-65 if the New York institutions had used the same classification scheme that was used in 1968. This was done through an institution-by-institution comparison of enrollments for 1965 and 1968. The resulting adjusted estimates of nondegree-credit enrollments for the U. S. were as follows: 1963 -- 206,000 (138,000 men, 68,000 women); 1964 -- 251,000 (164,000 men, 87,000 women); 1965 -- 304,000 (196,000 men, 108,000 women). It should be noted that there were suspicious-looking jumps in nondegree-credit enrollments in other states between 1965 and 1968, so that the adjusted estimates may also distort the growth of nondegree-credit enrollment, perhaps in the opposite direction.

If the adjusted estimates can be accepted at face value, then nondegree-credit enrollment for men accounted for about 18% of the increase in male prebaccalaureate enrollment between 1963 and 1970; for women, it accounted for about 16% of the increase. (These percentages are actually slopes of regression lines fitted to separate plots by sex of nondegree-credit enrollment versus total prebaccalaureate enrollment for the years 1963-65

and 1968-70.)

The projections of prebaccalaureate and nondegree-credit enrollment in Table II result from the assumptions that prebaccalaureate degree-credit enrollment will rise at the same rate as undergraduate degree-credit enrollment (see Table I) and nondegree-credit enrollment for each sex will account for the same percentage of future increases in total prebaccalaureate enrollment as was estimated above for the period 1963-70.

THE JUNIOR COLLEGE MOVEMENT

Perhaps the most significant development in higher education in the last decade has been the expansion of the junior college movement. According to NCES data, the number of two-year institutions in the U. S. increased from 521 in 1960 to 891 in 1970, and total enrollment in these institutions more than tripled -- from 617,000 in 1960 to 2,210,000 in 1970. These data do not include the two-year branch campuses of universities, which have expanded about as rapidly as the other two-year institutions. It was estimated in [3] that there were 127 two-year branch campuses in 1968, most of which were in five states -- Pennsylvania, Ohio, Kentucky, Wisconsin, and South Carolina.

The major impact of the junior college movement has been to democratize higher education by removing the geographic, economic, and academic barriers to college attendance for hundreds of thousands of students. A majority of today's high school graduates already live within commuting distance of a low-cost, open-access junior college and, if a recent proposal by the Carnegie Commission on Higher Education is adopted [3], 230-280 new campuses will be created between 1968 and 1980, bringing 95% of all potential students within commuting distance of a junior college.[1]

The creation of an open-admission junior college can have a dramatic effect upon college enrollment rates among high school graduates in that

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[1] In his study of the accessibility of institutions, Warren Willingham [43] estimates that adoption of the Carnegie Commission proposals would increase the proportion of potential students within commuting distance of free-access institutions from 42% to about 70% in 1980. However, his "commuting distance" ranges from only 2-1/2 miles in the largest cities to 25 miles in rural areas.

community. Medsker and Trent [16] reported that the proportions of high school graduates who entered college from various communities with different types of public colleges were: junior college, 53%; state college, 47%; extension center, 34%; no college, 33%. They also found that among the academically able young people whose fathers were semiskilled or unskilled laborers, 53% of those from communities having junior colleges attended college, as compared with only 22% among those from communities having no public college.

Bashaw [1] compared college attendance rates for certain counties in Florida which had no community college throughout the period 1957-62 with other counties that had no community college before 1958 but created one between 1958 and 1960. For six counties in the first category, the attendance rates (ratio of number of county residents enrolled in some college in the state to total county population) averaged 0.84 in 1957 and 0.95 in 1962; for nine counties in the second category, the average of the attendance rates jumped from 0.78 in 1957 to 1.68 in 1962.

The junior colleges have also broadened the scope of higher education. Large numbers of college age youth are attracted by the extensive occupational programs offered by these institutions. Although most junior college students are in "transfer programs," more than one out of four are enrolled in occupational programs (see Table 11). Many of these students, either because of their interests or their academic aptitudes, would not enter college if it were not for the availability of job-oriented courses that lead to productive careers in such fields as business, electronics, nursing, and data processing. The community colleges also attract many adults through their cultural and continuing education programs. This aspect of higher

education will surely become more significant in the future.

Thus, the junior colleges, many of which were built to absorb the overflow from the four-year campuses, have attracted many additional students because of their accessibility and their job-oriented course offerings. The construction of large numbers of additional campuses in the next decade will provide a stimulus to increase undergraduate enrollment rates in the future, perhaps beyond the level indicated by the projections in Table 1.

For the last several years the two-year institutions have been taking larger shares of the annual increases in total prebaccalaureate enrollment, so that a plot of junior college enrollment versus total prebaccalaureate enrollment shows evidence of a slight "quadratic effect." However, if one looks at separate plots for degree-credit enrollment and "adjusted" nondegree-credit enrollment, this quadratic effect disappears.

The adjustments to nondegree-credit enrollments are of the same type as those discussed in the preceding section. It is estimated that junior college nondegree-credit enrollment in 1965 would have been 248,000 if New York institutions had used the same definition of degree-credit status as they used in 1968; the corresponding estimates for 1963 and 1964 were 160,000 and 204,000 respectively.

From the adjusted data, it was estimated that the junior colleges have taken 33% of the increases in prebaccalaureate degree-credit enrollment and 91% of the increases in nondegree-credit enrollment. (These percentages are the slopes of regression lines fitted to the adjusted data for the six years 1963-65 and 1968-70.) The projections of junior college enrollments given in Table 11 are based on the assumption that this trend will prevail

in the future.

These projections of junior college enrollment are much higher than the NCES projections in [22]. Their projections of total and nondegree-credit enrollments in two-year institutions for 1978 are 3,075,000 and 899,000 respectively. The projections given here for these categories are 18% and 27% higher than the NCES projections.

THE SHIFT TOWARD PUBLIC EDUCATION

A 1967 Fortune article [25] summed up the crisis that hangs over private institutions of higher learning with their title, "Private Colleges: A Question of Survival." In that article, Allan Cartter, chancellor of privately supported New York University, was quoted as saying, "Without a shift in current trends, I would anticipate the absorption into state systems of all but a handful of the strongest private universities." William G. Bowen [2] has given an analysis of the financial plight of private universities in which he indicates that even major private universities "will be unable to continue to meet their current responsibilities, let alone to develop in step with national needs." More recently Earl Cheit, in his survey of the financial status of institutions [5], concluded that 82% of the private schools in his sample were in financial difficulty.

The statistics on enrollment in private colleges and universities tend to support the dire predictions. (See Table 12.) The proportion of students in private institutions dropped from 40% in 1960 to 25% in 1970. Since 1966, enrollment in private institutions has risen only 86,000, whereas the public institutions have added 2.0 million students during the same period.

In examining the apparent leveling off of the aggregate enrollment for all private institutions, one must consider the fact that some very large universities have recently undergone a transition from private to public control. In 1967, the University of Pittsburgh and Youngstown University, with a combined enrollment of over 35,000, were reclassified as public-supported institutions by NCES. Among the other private institutions, there was a 4% increase in enrollment between 1966 and 1967.

Table 12

Total Enrollment by Control and Type of Institution, 1960-70

Year	Total Enrollment (in thousands)					
	Public			Private		
	2-year	4-year	Total	2-year	4-year	Total
1960	526	1751	2277	91	1421	1512
1961	572	1898	2470	95	1483	1578
1962	668	2084	2753	105	1546	1651
1963	735	2331	3066	109	1590	1700
1964	875	2593	3468	114	1698	1812
1965	1041	2928	3970	132	1820	1951
1966	1190	3159	4349	137	1904	2041
1967	1372	3444	4816	141	1955	2096
1968	1646	3784	5431	146	1937	2082
1969	1818	4021	5840	124	1953	2077
1970	2090	4281	6371	120	2007	2127

In 1968, Temple University, with 34,000 students, was reclassified by NCES; this more than accounts for the overall drop of 14,000 in private enrollments between 1967 and 1968. There were no reclassifications of large universities by NCES between 1968 and 1970.

After considering the reclassifications, the 2.4% increase in private enrollments between 1969 and 1970 seems to stand out as a small, but perhaps significant, departure from the leveling off of private enrollments during the preceding years. Among the states having private enrollments of over 30,000, all but one showed percentage increases in private enrollments close to the national figure. The exception was California, where private enrollments increased 9.2% between 1969 and 1970 despite the presence of a well-developed junior college system. In the preceding year, the California private schools had a gain in enrollment of over 3%, whereas the private schools for the rest of the nation showed a net loss. Most of the larger private institutions in California have shown greater percentage gains between 1968 and 1970 than the overall rate of increase for the public institutions. Some possible contributing factors are the enforced curtailment of future growth at UCLA and Berkeley and the tuition increases at the state universities and colleges (although it seems implausible that many students would react to this increase by electing to enroll at private institutions having much higher tuitions). Perhaps the numerous disruptions on the state university and college campuses have driven some students away from the public institutions.

The thesis that campus disturbances have had a pronounced effect upon enrollment patterns is supported in a recent article by Robert Reinhold [27] in which he compares the number of applications for admission for the academic

year 1971-72 with those of the previous year. Kent State has had a 46% decline; Wisconsin, 16%; Harvard, 11%. Columbia had a sharp drop in applications after the disturbances of 1968.

In the long run it has been the spiraling tuition costs, necessitated by the financial plight of the private institutions, that have led to the decline in enrollment applications at the private schools. Tuition in these institutions has increased at a rate far exceeding that for family income [25], so that the private schools have been competing among themselves for a shrinking proportion of the student population. At the same time they are being priced out of the market, even among those students who can afford to pay their own way, by the expanding network of high-quality public institutions.

Table 12 suggests that the private two-year colleges have suffered sharp drops in enrollment during the last two years. Actually, this is an artifact resulting from the reclassification of over 20 private colleges from two-year to four-year status during this period.

The data on first-time enrollment for the last few years provide information on the possible short-term growth in private enrollments. The total first-time enrollments (including nondegree-credit students) in private institutions for the years 1966-70 were: 1966 --449,000; 1967 -- 435,000; 1968 -- 450,000; 1969 -- 456,000; 1970 -- 457,000. Clearly, the first-time enrollments are leveling off, and unless the means of financing higher education are changed to make the private colleges beneficiaries of substantial federal or state aid, perhaps in the form of grants to students, it seems unrealistic to assume that total enrollment in private institutions will rise much beyond the 1970 level.

SOME IMPLICATIONS FOR THE FUTURE

In the past, the American system of higher education has somehow met the demand for student places through tremendous increases in enrollments and costs. Since the projections given throughout this paper assume that past time trends will prevail, it is implicit in these projections that, first, the demand for higher education will continue to rise at the rates projected here and, second, the institutions of higher education will be able to meet this demand as they have in the past.

No one seems to doubt that the demand for higher education will continue to rise, but there may be good reason to doubt that the colleges and universities can continue to meet this demand. The private institutions appear to be approaching the limit of their capabilities insofar as further increases in enrollment are concerned. The public institutions are also having to cut back on some of their programs as governors and state legislators react to rocketing costs and student disruptions on campus. Recent cuts in research support by various government agencies may already have seriously affected the future capability for growth at the graduate level.

Unless some action is taken to help the private colleges, all the future enrollment growth will have to be absorbed into state-supported schools. Educators may prefer to look ahead at the anticipated decline in enrollments in 1982, but in the meantime places for 5 million additional students must be created, according to our projections. The magnitude of this task becomes apparent when one realizes that this exceeds the phenomenal expansion of enrollments in public institutions during the past ten years, when places for 4.1 million additional students were created.

If past trends persist, the junior colleges will accommodate about one-third (1.7 million) of the projected increase of 5 million students between 1970 and 1982. However, it is hoped that more states will follow the lead of California, Florida, Oregon, and Washington by creating a network of comprehensive community colleges capable of absorbing more than 60% of the undergraduate enrollment increases. If so, then almost half of the projected increase in total enrollment between 1970 and 1982 could be accommodated in these colleges. This would provide educational opportunities for more students at lower cost, both to the students and to the states, and would go a long way toward democratizing higher education through the elimination of the traditional barriers to college attendance and the provision of a variety of educational programs that are better adapted to the needs of college students of the future.

APPENDIX. SOURCES OF THE DATA

The sources for the data on total enrollment and total degree-credit enrollment for the years up to 1968 are [17], [40], the latest edition of Projections of Educational Statistics [22], and earlier editions of the Projections. The 1969 and 1970 data on total enrollment come from [21] and unpublished data from NCES on the 1970 opening fall enrollment survey. The 1969 and 1970 data on total degree-credit enrollments are estimated from total enrollment using the assumption that the ratio of degree-credit enrollment to total enrollment within each of the eight categories resulting from classifying enrollment by sex, control (public or private), and level (two-year or four-year) was the same as the corresponding ratio in 1968, as determined from [20].

The estimates of graduate resident and undergraduate degree-credit enrollment for the years up to 1955 are based upon data given in [40]. The estimates for the years 1957-1963 result from breaking down total degree-credit enrollment by level and sex using the corresponding ratios in these categories derived from the biennial "comprehensive enrollment surveys" from 1957 to 1963. (See [39].) The analogous ratios for the even-numbered years are estimated by interpolation. The 1968 estimates of graduate resident enrollment are taken from [23]. The estimates for the years 1964-67 and 1969 result from applying yearly growth rates in enrollments for advanced degrees, as determined from [24] and earlier publications in the same series, to the estimated graduate resident enrollments for 1963 and 1968. The resulting estimates of graduate resident enrollment differ considerably from those published in [22]. It is

regrettable that the recent NCES counts of graduate enrollments, including those of postbaccalaureate enrollment in the 1967 and 1968 opening fall enrollment surveys, are neither comparable with one another nor with earlier counts. Although the annual counts of students enrolled for advanced degrees also require some piecing together to achieve year-to-year continuity, it is believed that the estimates given here of graduate resident enrollment through 1969 reflect the growth of graduate enrollments more accurately than the somewhat lower estimates given in [22]. The 1970 estimates result from projections of graduate resident enrollment given in [10].

The estimates of the sizes of the age groups in Table 2 are Bureau of the Census estimates from [32] and earlier publications in the P-25 Series. The Series D projections of sizes of age groups come from [34]. The historical data on numbers of high school graduates given in Table 2 are taken from [22], earlier editions of the Projections, and [17].

The estimates of first-time degree-credit enrollment given in Table 3 for the years 1969 and 1970 were derived in the same manner and from the same sources as the estimates of total degree-credit enrollment for these years. The sources of the data up to 1968 are [17] and [22].

The data on veterans in Tables 3 and 9 come from [7], [38], [42], and earlier annual reports of the Administrator of Veterans Affairs. The data on numbers of draft calls in these tables come from [12], [41], and earlier issues of the Selective Service News.

The estimates of numbers of bachelor's and first-professional degrees in Table 6 are based upon data in [18] and earlier publications in the same series. Before 1961, the number of bachelor's degrees was not reported

separately but was included in the counts of bachelor's and first-professional degrees. Estimates of the numbers of first-professional degrees for the years 1950-60 were obtained using growth rates in degree production for the combined fields of dentistry, medicine, law, and library science.

The estimates of prebaccalaureate enrollment in Table 11 result from subtracting estimated postbaccalaureate enrollment from total enrollment. The 1968 data on postbaccalaureate enrollment are from [20]. The 1963 estimate is the total of the resident graduate and first-professional enrollments reported in [39], adjusted upward by a factor of 1.076, the ratio of postbaccalaureate enrollment to this total in 1968. For the other years up to 1969 the estimates are based upon the ratios of post-baccalaureate enrollment to graduate resident enrollment for the years 1963 and 1968. The 1970 estimates are projections of postbaccalaureate enrollment given in [10].

The sources of the data on nondegree-credit and junior college enrollments in Table 11 and the data on total enrollment by control and type of institution in Table 12 are the same as those given above for total and degree-credit enrollment.

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